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(54) Title: CUSTOMER SERVICE REPRESENTATIVE INTERACTIVE SYSTEM FOR DIAGNOSING AND RESOLVING PROBLEMS IN THE OPERATION AND USE OF WIRELESS TELECOMMUNICATION EQUIPMENT

(57) Abstract

A system for diagnosing a problem related to the use of a wireless communication device, such as a cellular phone, of a customer of a telecommunication network includes a customer service facility to which inquiries are directed by customers of the network in the event of problems with their cellular phones. The customer service facility has a plurality of workstations from which customer service representatives interact with customers to diagnose and resolve problems. In response to an incoming call from a customer, a workstation executes an automated diagnostic and problem resolution routine that is interfaced with one or more telecommunication databases and a network performance monitoring subsystem. This diagnostic routine generates a user interface that directs the customer service representative through a series interactive communication steps with a customer to diagnose the problem.

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## CUSTOMER SERVICE REPRESENTATIVE INTERACTIVE SYSTEM FOR DIAGNOSING AND RESOLVING PROBLEMS IN THE OPERATION AND USE OF WIRELESS TELECOMMUNICATION EQUIPMENT

The present invention relates to telecommunication networks and systems, and is directed to an improved diagnostic and problem resolution subsystem, that is readily interfaced with one or more databases and performance monitoring and expert systems of a telecommunication service provider, and is operative to facilitate the ability of a customer service representative to interact with a user/ customer seeking resolution of an inquiry, including but not limited to a problem related to the use of equipment, particularly a wireless device, such as a portable phone, and/or telecommunication services accessible by such equipment.

Customers of telecommunication service providers may subscribe to a variety of services and/or employ multiple types of telecommunication equipment, such as wireline, fiber optic and wireless components that are available from a number of different sources. Since customers are usually technically unsophisticated, whenever a problem is encountered, whether it be with service, billing, or the operation of a piece of equipment, for example, the first thing a customer can be expected to do is 'call the phone company and complain'. The customer's complaint query will ordinarily be routed to a service center workstation of a customer service representative, who interacts or converses with the customer, while accessing a customer database containing the customer's account.

Where the customer's complaint relates to the ability to place a wireline call or the quality of a wireline connection, the customer service representative will often schedule a service request for the subsequent attention of a skilled technician or craftsman. The service technician may initially attempt to resolve the problem by performing diagnostic testing of the subscriber line from a dedicated network test facility; if unsuccessful, the servicing craftsman may eventually have to travel to the customer premises and perform on-site testing of the customer's equipment.

Wireless communications offer an additional set of problems, not the least of which is the fact that since the communication channel is wireless, a link between the customer's wireless

device (e.g. a portable cellular phone) and the telephone service provider's equipment is not continuously available, so as to prevent hard line access from a remote test subsystem at a servicing office to the customer's line or device. As a consequence, in the past, when a customer has encountered problem with wireless service, the focus has been upon the customer's equipment (portable phone) as the assumed source of the problem, and a frequent initial request has been to ask the customer to return the phone to point of purchase or manufacturer for testing, service and/ or replacement.

When the retail price of a wireless phone was in the neighbourhood of U.S. \$1000, there was incentive for the retailer to invest in (expensive) test equipment and training of service personnel to troubleshoot a potentially faulty wireless device. Today, however, the price of a cellular phone has dropped substantially to only a fraction of this value; moreover, after subsidies and rebates, a customer can now expect to receive the phone at virtually no cost, so that the phone is effectively viewed as 'disposable'. As a result, not only are customers usually unwilling to pay for a phone's repair, but a seller does not wish to invest substantial capital on equipment to test a 'disposable' device. An additional and not insignificant complication is the fact that, for the vast majority of customer complaints that their phones 'don't work', after testing, the phone is found to be in perfect working order, namely, a 'no trouble found' or 'NTF' phone.

Because the service provider's revenue is derived principally from usage time, and the wireless phone per se is not considered a significant item of revenue, it is the wireless carriers who incur the large cost of handling NTF phones, and therefore seek a solution to the 'NTF' wireless equipment usage problem. One proposal has been to transfer the burden of phone testing (from the points of sale of the wireless equipment) to regional carrier depots. Shortcomings of this approach include the unwanted middleman participation of point of sale personnel in receiving the phone from the customer and then sending the phone to the depot, the increased time to ship the phone from the point of sale to the depot, and the need for the carrier to refurbish an NTF phone before supplying it to a pool of 'loaner' phones, the number of which also must be larger than necessary to replace truly defective phones.

The present invention includes a method of using a telecommunication network having a customer service facility to which inquiries may be directed by a user of said network for resolution of a problem related to the use of a wireless communication device or telecommunication services accessible by such device, a method of obtaining a resolution of said problem comprising the steps of:

(a) providing a telecommunication workstation at which a customer service representative may communicate with said user of said network, said workstation being coupled to an automated diagnostic and problem resolution routine that is interfaced with one or more telecommunication databases and a network performance monitoring subsystem of a telecommunication service provider, said routine being operative to generate a user interface at said workstation through which said customer service representative is guided through a series interactive communication steps with said user to diagnose said one or more problems related to the use of said wireless communication device; and

(b) in response to an inquiry from said user of said system for resolution of a problem related to the use of said wireless communication device or telecommunication services accessible by such device, executing said routine so as to cause said workstation to direct a customer service representative through said series of interactive communication steps with said user that diagnose said problem.

The invention also includes a system for diagnosing a problem related to the use of a wireless communication device employed by a customer of a telecommunication network, comprising a customer service facility to which inquiries are directed by customers of said network in the event of problems related to the use of said wireless communication device in conducting communications over said network, said customer service facility having a plurality of telecommunication workstations at which a customer service representatives may communicate with said customers, and wherein a respective workstation is operative to execute an automated diagnostic and problem resolution routine that is interfaced with one or more telecommunication databases and a network performance monitoring subsystem of said network, said routine being operative to generate a user interface at said workstation that directs a customer service representative through a series interactive communication steps with said customer to diagnose said problem, including selectively instructing said customer to place a can from said wireless

communication device to a test site and thereby place said wireless communication device in a test path with performance monitoring equipment at said test site.

An object of the present invention is to solve the problems successfully by a new and improved automated diagnostic and problem resolution subsystem, that is readily interfaced with one or more databases and performance monitoring and expert systems of a telecommunication service provider, and is operative to facilitate the ability of a customer service representative to interact with a customer seeking the resolution of an inquiry, including but not limited to a problem related to the use of equipment, particularly a wireless phone, and/or telecommunication services accessible by such equipment.

Advantageously, the software-based mechanism of the invention facilitates customer service interaction by generating a windows-based graphics user interface on the service representative's workstation. The information is displayed in a manner that will guide the service representative through a series of interactive communication steps with an inquiring customer. As a result, to the extent possible, a customer inquiry, including but not limited to the use of wireless equipment and/ or telecommunication services accessible by such equipment, can be readily diagnosed and the problem resolved from the customer service representative's workstation.

Conveniently, a telecommunication system in which the invention may be installed may include one or more central offices of a telecommunication services provider, that are wireline-linked to each other and to a number of distributed sites, such as customer premises, local retail points of sale, and one or more points of sale owned by a wireless carrier. The central offices may be wireline-linked to a mobile telephone switching office, which is linked to a cellular base station 33. In addition, the mobile telephone switching office is linked to a customer service facility staffed by one or more customer service representatives. The service representatives' workstations are linked to and are configured to execute the automated diagnostic and problem resolution system of the invention so as to allow any customer service representative to interact with any customer seeking resolution of a question or problem, such as that related to the use of a wireless device, and/ or telecommunication services accessible by the device.

In accordance with a first proactive subroutine of the automated diagnostic and problem resolution system of the invention, various sites and equipment of a network performance subsystem employed by the telecommunication service provider to maintain network communication integrity are continuously monitored for anomalies that may impair or interrupt wireless service to one or more customers and thereby stimulate one or more complaint inquiries from customers. If one or more network anomalies or unusual conditions occur, the subroutine will declare an exception representative of a potential problem, that may give rise to one or more customer complaints. What constitutes an exception is definable by the telecommunications carrier. If an exception is detected, the exception data is used to access a database containing customer service representative procedure rules associated with the exception. In addition, in an alarm pointer to customer service representative workstations is generated.

One of the key features of the invention is that it automatically generates an online guide for the customer service representative. This on-line guide enables the customer service representative to efficiently interact with a customer to diagnose and solve a customer perceived problem. In addition, in many instances, as in the case of monitoring network situations it anticipates the problem and alerts customer service representative workstations to the likelihood of incoming complaint calls related to the detected anomaly.

For this purpose, the graphic user interface displayed on the customer service representative's workstation monitor may employ a windows-based screen format. In addition to various menu items, a map showing the location of the customer within the network may be displayed. Also, to assist the customer service representative in handling the customer's inquiry, on-line instructions associated with the respective steps of the subroutines to be described are successively displayed. This window may be used, as appropriate, to enter a response from the customer.

The present invention executes a utilities and customer inquiry/problem subroutine, in response to a customer logging on to a system interface, such as a remote communication terminal installed at a point of sale, and placing a digital communication form that terminal, or in

response to a call from a customer (e.g., dialling a prescribed customer service access code, such as #611). Where, the customer logs into the system via a computer terminal, the subroutine causes a graphical user interface to be displayed at the remote terminal. In addition, the customer service representative may interact with the customer as necessary.

The interface generated on the remote terminal is used to interrogate the customer by requesting that the customer supply various customer associated information, such as identification, equipment type or problem information. Based upon the information supplied by the customer, the subroutine will then ask the customer to select either a utility option or a call handling option. By utility option is meant that the customer is seeking information relating to the customer's service contract with the service provider, such as the contents of a billing statement or equipment configuration information. By call handling option is meant that the customer is seeking to remedy a connectivity problem, such as a degraded operation of the phone.

If the utility option is selected, the subroutine retrieves and displays the requested information to the customer. Once the customer has received the answer to the utility inquiry, the subroutine transitions to a marketing exit step which provides the customer service representative with the ability to inform the customer of marketing information, such as service options to which the customer may wish to subscribe, as a non-limiting example, before terminating the session.

Where a customer has come to the point of sales or customer service facility with a connection problem, however, the customer will have invoked a call handling option on the initially displayed user interface, causing a call handling subroutine to be called up. This subroutine, which involves interactive participation by a customer service representative, is the same on-line customer interaction guide subroutine that is automatically accessed and displayed to the customer service representative in response to a customer call inquiry.

At the start of the call handling subroutine, the customer service representative will ask the customer for identification, to ensure accurate customer identification for security purposes in conducting an information sharing dialogue with the customer. The customer's complete record, including account, service and complaint history information is then displayed within the

subscriber information window of the graphic user interface. The service representative is then instructed to ask the customer to describe the reason for the call. After entering this information, the service representative selects the appropriate option (e.g., billing, marketing promotion, equipment problem, poor line quality) within a displayed menu of purpose options that is considered to categorize the purpose of the call or problem, as described by the customer.

↓ The subroutine then accesses information from a corresponding database and displays a listing of items associated related to the customer's inquiry. The accessed information allows the customer service representative to verify the customer's inquiry. For example, if in the customer is complaining of a connection problem, such as a dropped call, that complaint may be verifiable from an examination of call history information stored in the network performance management system. Similarly, if the customer's inquiry relates to a class of service option, that inquiry can be readily compared with the customer's account and marketing information.

If the accessed information does not provide a direct verification of the customer's inquiry (for example, what the customer stated may not be not accurate), an auxiliary database, such as an expert system, containing information relating to the customer's equipment, that may readily lead to a resolution of the problem is accessed. Interrogating an expert system containing information that has been accumulated on equipment of the type employed by the customer may reveal one or more aspects of the customer's particular equipment that have been identified as potential sources of the particular complaint.

The call handling subroutine further inquires whether the interaction between the customer service representative and the customer has successfully identified and solved the problem for a given diagnosis listing. If so, the database is updated and the subroutine prompts the customer service representative with the option of asking marketing questions, before terminating the call. Whether or not such questions are asked be left up to the customer service representative, based upon the previous dialogue with the customer.

If the problem is not solved, the customer service representative may again interrogate the expert database, to determine whether another probable resolution of the problem is listed. If so,

the customer service representative may select another cause option from the displayed list of diagnosis statements and interact with the customer in an attempt to resolve the problem by having the customer following the service representative's instructions, as described above. This sequence is repeated to the extent necessary until either the problem is solved or the initial call handling subroutine fails to solve the problem.

If the initial call handling interaction between the service representative and the customer does not solve the problem, the customer service representative is instructed to ask the customer to assist in conducting a test of the problematic piece of subscriber equipment (portable phone). In particular, the customer is requested to use that piece of equipment to dial a separate customer service number associated with a further level of problem analysis and technical service support that will place the equipment in communication with a test facility. The test facility may then be able to resolve the problem without the customer having to return a piece of equipment to a service center.

Although the customer will normally accede to the service representative's request, it is possible that the customer will refuse. In this case, the customer service representative informs the customer that the only practical thing is to return the phone. If the customer agrees, that consent is entered by the customer service representative in the database, and the subroutine instructs the service representative to provide prescribed usage and transport information to the customer.

However, if the customer refuses to return the phone for service or replacement, the customer service representative is prompted to inform the customer that he may continue to use the phone and, whenever convenient, to take the phone to a service center. The customer's refusal may be due to the fact that even in its degraded operational state the phone is still useful and the customer does not wish to part with the phone at present. In response to an indication that the customer will continue to use the phone, the customer service representative provides prescribed usage and transport information to the customer.

Where interaction between the service representative and the customer does not solve the problem, and the customer agrees to place a call via the problematic portable phone to a separate customer service number that will place the equipment in communication with a test facility, the initial call handling subroutine transitions to a phone test subroutine, which executes a further level of problem analysis by means of a test facility. The test facility may then be able to resolve the problem without the customer having to take the phone to a service center.

Once the customer has placed a call via the equipment of interest (portable phone) to the technical support number, the customer is queried to confirm that the call has been placed to a test facility containing test equipment to which incoming calls are directed. The test subroutine then branches to and runs a performance monitoring routine on the customer's phone, in order to establish that the phone has operational capability.

The network performance management system is interrogated to determine whether or not signals being received from the customer's phone are within prescribed ranges of acceptable operation. The test subroutine causes the network performance management system to measure how the network is responding to the phone under test, namely whether network parameters are within specified acceptable ranges or is there anomalous behaviour, indicating a problem in the network itself, and the network performance management system is interrogated for the presence of a fault.

If these measurements confirm that a fault exists, the source of the fault - the phone or the network - is identified and the database is updated to reflect the detected fault. If the fault lies with the customer's phone, the customer service representative instructs the customer that the phone has been found to be faulty and must be replaced.

If the fault lies with the network, the service representative informs the customer that the phone is in proper working order, and may advise the customer that steps are being taken to correct the fault in the network. Depending upon the type of fault, the time to correct the fault may vary, with an indication of the repair or correction time being supplied by the network performance management system.

If the network measurements are unable to confirm a fault in the network or the phone, the test subroutine causes the channel between the phone and the network to be routed to a test set. The network performance management system is again interrogated and parametric tests are executed from the test set on the terminated channel. The test set is then interrogated to determine whether the measured parametric data gathered by the test set indicates an operational anomaly with the phone. If a fault is confirmed, the database is updated to reflect the detected faulty phone, and the customer service representative instructs customer that the phone has been found to be faulty and must be replaced. If the test set is unable to confirm the presence of a fault in the customer phone, the customer service representative supplies usage information to the customer. In addition, the customer service representative advises the customer that he may continue to use the phone, but to take the phone to a service center if the problem persists.

The invention will now be described by way of example, with reference to the accompanying drawings in which:

FIGURE 1 is a simplified diagrammatic illustration of a wireless telecommunication system;

FIGURES 2-5 are flow charts of subroutines employed in the automated telecommunication diagnostic and problem resolution system of the invention;

FIGURE 6 shows an example of a graphic user interface that may be displayed on a customer service representative's workstation monitor by the diagnostic and problem resolution system of the invention; and

FIGURE 7 is a diagrammatic representation of a system embodying the present invention.

It should be observed that the present invention resides primarily in what is effectively a set of software modules that are installed in and executable by a supervisory control computer of a telecommunication service facility, for controllably and automatically accessing each of

customer information, network performance and equipment evaluation, legacy and expert subsystems and databases, as well as enabling connectivity between a customer's equipment and a test facility. The subsystems and databases themselves may include those customarily provided by both telecommunication service providers and equipment manufacturers and will vary among providers and manufacturers.

The software-based system of the present invention is operative to generate a windows-based graphics user interface on a customer service representative's workstation, containing banner, window and key icons, the contents of which serve to guide a customer service representative through a series of interactive communication steps with an inquiring customer. As a result, to the extent possible, the customer's inquiry (complaint), including but not limited to the use of wireless equipment and/ or telecommunication services accessible by such equipment, can be readily diagnosed and the problem resolved directly or indirectly from the customer service representative's workstation.

Consequently, the manner in which this invention communicates with and interactively controls the operation of one or more telecommunication devices, subsystems or databases have been illustrated in the drawings in readily understandable block diagram format, which show only those specific details that are pertinent to the present invention, so as not to obscure the disclosure with details which will be readily apparent to those skilled in the art having the benefit of the description herein. Thus, the block diagram illustrations are primarily intended to illustrate the major components of a telecommunication system in a convenient functional grouping.

Figure 1 is a diagrammatic illustration of a wireless telecommunication system comprised of one or more central offices (COs) 11 of a telecommunication services provider, that are linked by wireline communication paths (trunks) to each other and via wirelines to a number of distributed sites, such as a customer premises 13, shown as having a plain old telephone service (POTS) phone 15, and a cellular phone 17, a local retail point of sales site 19 and a point of sales site 21 owned by a wireless carrier. Typical customer equipment sold by the point of sales sites include, but are not limited to devices, such as portable cellular phones 17, hand held personal computers (HHPc)s 25.

The central offices 11 are also shown as being linked by a wireline trunks to a mobile telephone switching office (MTSO) 31 which, in turn, is linked to a cellular base station 33, through which wireless (radiowave) communications are conducted with wireless transceiver devices, including hand held cellular phones and other types of equipment, such as a vehicle-installed radiophone in a vehicle 23. The mobile telephone switching office 31 is (usually wireline) linked to a customer service facility 35 that is staffed by one or more customer service representatives 36 at a plurality of workstations 37. The customer service workstations 37 are linked to and are configured to execute the automated diagnostic and problem resolution system of the present invention to be described below with reference to Figures 2-6, so as to allow any customer service representative to interact with any customer seeking resolution of a question or problem, such as that related to the use of a wireless device, and/ or telecommunication services accessible by the device.

In order to maintain network communication integrity, the telecommunication service provider employs a network performance monitoring subsystem that is operative to continuously monitor various network and communication sites and equipment. In accordance with a first proactive subroutine of the automated diagnostic and problem resolution system of the invention and reflected in the flow chart of Figure 2, this network performance subsystem is monitored, as shown at step 101, for the occurrence of anomalies that may impair or interrupt wireless service to one or more customers and thereby stimulate one or more complaint inquiries from customers.

In step 103, the proactive subroutine interrogates data and interrupts generated by the network monitoring subsystem associated with network paths and components and looks for anomalies and parameter unusual conditions. If one or more network anomalies or unusual conditions occur, then in step 105, the subroutine will declare an exception, namely a condition representative of a potential problem that may give rise to one or more customer complaints, such as would occur in the case of a base station power failure.

The proactive subroutine continues to loop through the network performance monitoring sequence of steps 101-103. However, if an exception is noted in step 105, the subroutine

transitions to step 107, and the exception data is used as a vector to access a database containing customer service representative procedure rules associated with the exception. In addition, in step 109, an alarm pointer to customer service representative workstations is generated. What constitutes an exception is definable by the telecommunications carrier. For example, a base station power failure would constitute a catastrophic interruption of service and would constitute an exception.

However, the failure or unacceptably degraded operation of a given piece of base station equipment such as downconverter module, for example, may not necessarily invoke an exception, if that piece of equipment has an auxiliary back-up unit, that is switched in its place when a degradation or failure occurs, and service to the customer is not interrupted or substantially adversely affected. Namely, while such an event may invoke a trouble ticket for repair or replacement by a field technician, it need not alert the customer service representative, since the customer's use of the service has not been effectively impaired.

A key feature is the fact that it automatically generates an on-line guide for the customer service representative. Advantageously, this online guide (to be described in detail below with reference to the flow charts in Figures 3-5) enables the customer service representative to efficiently interact with a customer to diagnose and solve a customer perceived problem. In addition, in many instances (as in the case of a network anomaly, such as that caused by a minor equipment failure at a base station, for example), it anticipates the problem and alerts customer service representative workstations to the likelihood of incoming complaint calls related to the detected anomaly.

For a catastrophic network failure, such as a severed fiber optic cable, this alert may be supplied as a bold/flashing audio-visual message to each workstation. For a local anomaly, such as one that will likely impair service to one or more customers in geographical cell served by a given base station, the alert may be produced as a noticeable but not distracting visual alarm indicator, such as a highlighted or slowly blinking red region on a prescribed portion (e.g., upper corner region) of the workstation's display graphic user interface, so as not to interfere with the current task of the customer service representative.

Then, in response to receiving an incoming customer (complaint) call such as by the customer dialling a prescribed number, such as #611 (which complaint has some likelihood of being caused by the exception), the customer service representative has the ability to immediately access (as by a point and click on the displayed alarm indicator, for example) a set of rules or procedures that have been predefined by the carrier for each type of exception. Typically, although not necessarily, a respectively different set of procedures will be defined for a respectively different type of alarm. Invoking the alarm indicator will call up a menu of pending alarms from which the customer service representative may choose.

This not only enhances the efficiency with which the customer service representative is able to respond to the customer's inquiry, but, because of the automatically generated on-line guide, it enables the customer service representative to quickly interact with the customer to diagnose or identify the probable source of the problem, and to indicate how much time may be required for its resolution. Since the network monitoring system knows the number of any incoming call, that number may be compared with those having been determined to be affected by the exception (for example those in a given area code or central office), to determine whether that number is affected by the exception, and to thereby control the procedure set to be supplied to the customer service representative. Once the exception has been corrected, the alarm is terminated, and the routine returns to step 101.

Figure 3 is a flow chart of a utilities and customer inquiry/ problem subroutine, that is executable by the automated diagnostic and problem resolution system of the invention, in response to a customer logging on to a system interface, such as a remote communication terminal installed at the local retail point of sales site 19 or the point of sales site 21 owned by a wireless carrier, diagrammatically illustrated in Figure 1, reference above, and calling the customer service facility 35.

In response to being accessed in step 201, the subroutine is operative to cause a graphical user interface to be displayed at the remote terminal. The generated interface interrogates the customer at step 203 by requesting that the customer supply various customer associated

information, such as identification, equipment type or problem information. Based upon the information supplied by the customer, step 205 of the subroutine will then ask the customer to select either a utility option or a call handling option. By utility option is meant that the customer is seeking information relating to the customer's service contract with the service provider, such as the contents of a billing statement or equipment configuration information. On the other hand a call handling option, such as a degraded operation of the phone, will evoke the call handling subroutine of Figure 4.

If the utility option is selected (the answer to step 207 is 'utility', the subroutine retrieves the requested information and displays the information in step 209. In addition, as part of the displayed information, the customer is asked if more information is desired. If the answer to the query message in step 211 is YES, the routine loops back to step 201. If the answer to the query message in step 211 is NO, the routine transitions to a marketing exit step 213, which provides the customer service representative with the ability to inform the customer of marketing information, such as service options to which the customer may wish to subscribe, as a non-limiting example, before terminating the session.

Where a customer has come to the point of sales or customer service facility with a connection problem, however, the customer will have invoked a call handling option on the initially displayed user interface, causing the answer to step 207 to invoke the call handling subroutine of the flow chart of Figure 4. This call handling subroutine, which involves interactive participation by a customer service representative, is the same online customer interaction guide subroutine that is automatically accessed and displayed to the customer service representative in response to a customer call inquiry.

The graphic user interface displayed on the customer service representative's workstation monitor may employ a windows-based screen format, such as, but not limited to that diagrammatically illustrated in Figure 6. In addition to various menu items, a Callmap graphically depicting the location of the customer within the network may be displayed, as shown at 60. To assist the customer service representative in handling the customer's inquiry, on-line instructions associated with the respective steps of the subroutines to be described are successively displayed

in a Process Flow window 61. In addition, this window may be used, as appropriate, to enter a response from the customer.

Referring to the subroutine of Figure 4, at step 301, the process initially provides for the identification of the customer. For a customer inquiry initiated at a point of sales or customer service facility, this and other customer identification information will have been provided in step 203 of the flow chart of Figure 3. Figure 6 shows the customer identification contained in a Subscriber Information window 62. For a customer inquiry in a call placed to the customer service center, the number of the calling subscriber line circuit may have been obtained from an examination of caller ID information. Still, the customer service representative asks the customer for identification, to ensure accurate customer identification for security purposes in conducting an information sharing dialogue with the customer.

Given the requested customer identification information, in step 303 the customer's complete record (which typically may contain account, service and complaint history information) is accessed and displayed within the subscriber information window, in step 305. Next, in step 307, (using the subroutine directs the customer service representative to ask the customer to describe the reason for the call. After entering this information, in step 309, the service representative selects the appropriate option (e.g., billing, marketing promotion, equipment problem, poor line quality) within a displayed menu of purpose options that is considered to categorize the purpose of the call or problem as described by the customer.

In response to this menu selection by the customer service representative, in step 311, the subroutine accesses information from a corresponding database and displays a listing of items associated related to the customer's inquiry. For example, if the customer's inquiry involves a line quality complaint, and there has been a recent anomaly in that portion of the network serving the calling customer, then, the displayed listing will contain information accessed from the network performance management system related to that problem. (In the screen example of Figure 6, the currently displayed inquiry purpose window 63 provides a menu of performance-related options).

In step 313, the accessed information allows the customer service representative to verify the customer's inquiry. For example, if the customer is complaining of a connection problem, such as a dropped call, that complaint may be verifiable from an examination of call history information stored in the network performance management system. Similarly, if the customer's inquiry relates to a class of service option, that inquiry can be readily compared with the customer's account and marketing information.

If the accessed information does not provide a direct verification of the customer's inquiry (for example, what the customer stated may not be accurate), an auxiliary database, such as an expert system, containing information relating to the customer's equipment, that may readily lead to a resolution of the problem is accessed in step 315. For example, in the example of a dropped call, where the network performance management system reveals no problem with the network in step 313, it may be inferred that the problem resides elsewhere, such as in the customer's equipment. Interrogating an expert system containing information that has been accumulated on equipment of the type employed by the customer may reveal one or more aspects of the customer's particular equipment (such as a poor quality attachment of a portable phone's antenna, or a jittery battery terminal connector) that have been identified as potential sources of the particular complaint.

The information supplied by the expert system in step 315 will provide a list of potential causes of the problem and associated questions to present to the customer in order to diagnose the cause of the problem and what steps may be taken to remedy the complaint. In the example of a dropped call, the expert system may reveal that one of the defects for the particular piece of equipment used by the customer is a loose antenna, which may cause a call to be dropped. To the extent possible, each entry will also provide an explanation of how to correct for the listed defect, such as by tightening a rotatable fitting. Using this information, in step 317, the customer service representative selects from a displayed list of diagnosis statements 65 and interacts with the customer in an attempt to resolve the problem by having the customer following the instructions of the customer service representative (e.g., manually tighten the phone's antenna fixture).

In step 319 the subroutine inquires whether the interaction between the customer service representative and the customer has successfully identified and solved the problem for a given diagnosis listing. If the answer to step 319 is YES, the database is updated in step 321 and, at exit step 323, the subroutine prompts the customer service representative with the option of asking marketing questions, before terminating the call. Whether or not such questions are asked be left up to the customer service representative, based upon the previous dialogue with the customer.

If the answer to step 319 is NO, however, the subroutine transitions to step 325, where the customer service representative may again interrogate the expert database, to determine whether another probable resolution of the problem is listed. If the answer to step 325 is YES, the subroutine transitions to step 327, where customer service representative selects again from the displayed list of diagnosis statements and interacts with the customer in an attempt to resolve the problem by having the customer following the service representative's instructions, as described above. This sequence is repeated to the extent necessary until either the problem is solved by the subroutine transitioning to exit step 323, or the answer to step 325 is NO.

If the interaction between the service representative and the customer does not solve the problem (the answer to step 325 is no), the subroutine transitions to step 327, where the customer service representative is instructed to ask the customer to assist in conducting a test of the problematic piece of subscriber equipment (portable phone). In particular, the customer is requested to use that piece of equipment to dial a separate customer service number associated with a further level of problem analysis and technical service support detailed in the flow chart shown in Figure 5, to be described, that will place the equipment in communication with a test facility. The test facility may then be able to resolve the problem without the customer having to return a piece of equipment (e.g., cell phone) to a service center.

Although the customer will normally accede to the service representative's request in step 327, it is possible that the customer will refuse. In this case, in step 331 the subroutine instructs the customer service representative to advise the customer that the only practical thing is to return the phone. If the customer agrees, then in step 333, that consent is entered by the customer

service representative in the database, and the subroutine instructs the service representative to provide prescribed usage and transport information to the customer. The subroutine then transitions to exit step 323.

However, the customer may refuse. In response to a customer's refusal being entered by the service representative, the subroutine advances to step 335, which instructs the service representative to advise the customer that he may continue to use the phone and, whenever convenient, to take the phone to a service center (e.g., company depot or point of sale). In the course of this dialogue, the customer may indicate that even in its degraded operational state the phone is still useful and the customer does not wish to part with the phone at present. In response to an indication that the customer will continue to use the phone, the subroutine transitions to step 337, and instructs the service representative to provide prescribed usage and transport information to the customer. The subroutine then transitions to exit step 323.

Alternatively, the customer may realize that the only practical thing is to return the phone. In this case the latter instance, where the answer to the customer query step in step 335 is an agreed to return of the phone, the subroutine transitions to step 321, wherein the database is updated. It then transitions to exit step 323, before terminating the session.

If the interaction between the service representative and the customer does not solve the problem, and the customer agrees to place a call via the problematic portable phone to a separate customer service number that will place the equipment in communication with a test facility, the subroutine of Figure 4 transitions to the phone test subroutine of the flow chart of Figure 5, which executes a further level of problem analysis by means of a test facility. The test facility may then be able to resolve the problem without the customer having to return a piece of equipment (e.g., cell phone) to a service center.

More particularly, after the customer has agreed in step 327 to place a call via the portable phone to the technical support number, the subroutine transitions to step 401 of a test access routine of Figure 5, where the customer is queried to confirm that the call has been placed to a test facility containing test equipment to which incoming calls are directed. In step 403, the

subroutine then branches to and runs a performance monitoring routine on the customer's phone, in order to establish that the phone has operational capability.

Next, in step 405, the network performance management system is interrogated to determine whether or not signals being received from the customer's phone are within prescribed ranges of acceptable operation (e.g., proper power level). In step 407, the subroutine causes the network performance management system to measure how the network is responding to the phone under test, namely whether network parameters are within specified acceptable ranges or is there anomalous behaviour, indicating a problem in the network itself.

In step 409, the network performance management system is interrogated for the presence of a fault. If a fault is confirmed in step 411, then in step 413, the source of the fault (either the phone or the network) is identified and the database is updated to reflect the detected fault. If the fault lies with the customer's phone, the subroutine generates a message in step 415 instructing the customer service representative to advise the customer that the phone has been found to be faulty and must be replaced. If the fault lies with the network, the subroutine generates a message in step 417 instructing the customer service representative to advise the customer that the phone is in proper working order, and that steps are being taken to correct the fault in the network. Depending upon the type of fault, the time to correct the fault may vary, with an indication of the repair or correction time being supplied by the network performance management system. The subroutine then transitions to a marketing exit step 419, which informs the customer of marketing information, such as service options to which the customer may wish to subscribe, as a non-limiting example, before terminating the session.

If step 411 has failed to confirm a fault in the network or the phone, the subroutine transitions to step 421, which causes the channel between the phone and the network to be routed to a test set. In step 423, the network performance management system is again interrogated and in step 425 parametric tests are executed from the test set on the terminated channel. Once the tests are run, the subroutine interrogates the test set in step 427 to determine whether the measured parametric data gathered by the test set indicates an operational anomaly with the phone.

If a fault is confirmed in step 431, then in step 433, the database is updated to reflect the detected faulty phone, and the subroutine generates a message instructing the customer service representative to instruct the customer that the phone has been found to be faulty and must be replaced. The subroutine then transitions to marketing exit step 419. If the test set is unable to confirm the presence of a fault in the customer phone, the subroutine transitions from step 431 to step 435, wherein the customer service representative provides usage information to the customer. In addition, in step 437, the customer service representative is instructed to advise the customer that he may continue to use the phone, but to take the phone to a service center (e.g., company depot or point of sale) if the problem persists. The subroutine then transitions to step 439, to update the customer database, and then to marketing exit step 419.

The 'NTF' problems of wireless communication service providers are successfully addressed by the automated diagnostic and problem resolution system of the present invention, which is readily interfaced with one or more databases and performance monitoring and expert systems of a telecommunication service provider, and is operative to facilitate the ability of a customer service representative to interact with a customer seeking the resolution of an inquiry, including but not limited to a problem related to the use of equipment, such as a wireless phone, and/ or telecommunication services accessible by such equipment. As pointed out above, the software-based mechanism of the invention facilitates customer service interaction by generating a windows-based graphics user interface on the service representative's workstation. The information is displayed in a manner that will guide the service representative through a series of interactive communication steps with an inquiring customer. As a result, a customer inquiry may be readily diagnosed and the problem resolved from the customer service representative's workstation.

A system for diagnosing a problem related to the use of a wireless communication device, such as a cellular phone, of a customer of a telecommunication network includes a customer service facility to which inquiries are directed by customers of the network in the event of problems with their cellular phones. The customer service facility has a plurality of workstations from which customer service representatives interact with customers to diagnose and resolve

problems. In response to an incoming call from a customer, a workstation executes an automated diagnostic and problem resolution routine that is interfaced with one or more telecommunication databases and a network performance monitoring subsystem. This diagnostic routine generates a user interface that directs the customer service representative through a series interactive communication steps with a customer to diagnose the problem.

**Additional features of embodiments of the invention:**

**Dramatically Increase Revenues**

Harris' SmartCare System empowers your customer care agents to generate revenues by cross-selling and up-selling your service features and calling plans. It also guides your agents step-by-step through the telemarketing process. Now, even new agents can add to your bottom line.

**Significantly Reduce Costs**

Let the SmartCare system increase the efficiency of your customer care agents by guiding them through all customer calls, including those currently being transferred to expensive experts. Realise a 20% to 30% reduction in average call handling times within weeks. Increase job satisfaction and reduce turnover by empowering agents to resolve 30% of all trouble reports during the first call. Reduce your agents' training time from months to days.

**Exceed Your Customers' Expectations**

Use the SmartCare system to guarantee a consistently high level of customer service while measuring and improving agent performance.

**Deliver Customer Care Excellence**

Use the SmartCare system to reengineer your call center into a profit center and transform your customer service representatives into customer care experts.

Expert systems are currently available for wireline and wireless carriers and will soon be available for long distance carriers, internet service providers and CATV companies.

Accelerate your customer acquisition plan and enhance your customer loyalty programs.

#### **Billions of Dollars at Risk**

Competition is revolutionizing the telecommunications business. Privatization of international telephone companies, coupled with liberalization and deregulation of wireline and wireless markets, has unleashed competition world-wide. New competitive opportunities and threats are dramatically changing the way carriers do business. Industry experts forecast that existing carriers will lose significant market share to competitors. Arm yourself with the most effective competitive weapons to expand your share of this multi-billion dollar market.

#### **Don't Lose Your Best Customers**

To succeed in today's competitive environment you need an advantage that creates tangible value for your larger customers. More importantly, you must enhance your competitive advantage with superior customer service or lose your most profitable customers.

#### **The Essential Competitive Weapon**

The SmartCare system from Harris Corporation creates competitive advantage by reengineering the Interface between your two most important assets - your subscribers and your employees. The SmartCare system has built-in best practices, for handling calls that generate revenues, reduce costs and exceed your customers' service expectations. Harris will work with you to customize these best practices into processes that achieve your strategic objectives.

The field of invention is the use of an expert system by employees of wireless and wireline carriers, particularly customer service representatives and field technicians to increase revenues, reduce costs, and increase service quality by reengineering their customer care processes.

Specific examples of benefits of this advanced customer care system include:

Reducing costs by

Using the expert system to upgrade the skill set of customer service representatives to help them resolve problems more efficiently.

Using the expert system in conjunction with automated testing and diagnosis to filter erroneous fault reports. This will reduce the work load of field technicians and also increase their efficiency because the expert system will automatically gather relevant test data on confirmed problems.

Using all contact opportunities with customers to gain valuable proprietary market intelligence which will reduce customer acquisition and retention costs.

Reducing the cost of handling problems such as "no trouble found" ("NTF") phones. These phones can be filtered before the phone is returned to the wireless Carrier or phone manufacturer.

Reducing the carrier's investment in an excessive number of loaner phones which are used to replace NTF phones that are returned erroneously.

Increasing service quality and customer satisfaction by

Proactively analyzing the performance of the network and customer's phones to detect impending failures and resolve them before they occur.

Enabling customers to effect an annual check-up on the performance of their phone.

Reducing problem resolution time and shortening the time to get a replacement phone to the customer.

Educating the customer on the use of the phone and the network to prevent problems caused by user error.

Informing the customer of network problems in cases where the network rather than the phone is a more likely reason for a problem experienced by the customer, an issue that may affect customer satisfaction

Using customer comments to improve the data used to identify and isolate network problems and problems with specific models of phones and general service issues.

Increasing revenues by

Increasing customer satisfaction thereby increasing the customer's willingness to use more air time.

Keeping "no trouble found" ("NTF") phones in the hands of users so they can continue to use air time.

Proactively replacing phones that are about to fail before the failure thereby preventing user down time.

Using the contact opportunity to inform the customer about other available service features and special promotions then offering an immediate service upgrade.

Telemarketing.

This expert system has many benefits. This background analysis will focus on the reduction of the number of NTF phones that are returned to wireless carriers and manufacturers. Previously this problem was addressed by testing at the point of sale, "POS" (e.g. in cellular stores that sell phones and air-time contracts). When the retail price of a phone was \$1,000, it was worth the POS investing in expensive test equipment and spending 30 minutes or more to diagnose a faulty wireless phone. Today, phones cost \$200; after subsidies, customers can obtain a phone free of charge. From the viewpoint of both the customer and the POS, phones are disposable. Customers are not willing to spend \$100 to repair a "free" phone (for a non warranty repair) and the POS is not willing to spend more than a few thousand dollars on test equipment to test disposable phones.

However, wireless carriers and phone manufacturers still incur the large cost of handling NTF phones. Thus, wireless carriers are willing to make large investments to eliminate or significantly reduce this problem.

Previous attempts to reduce the NTF problem have been insufficient because:

The carriers are forcing the point of sale ("POS") to purchase equipment that the POS cannot afford.

The required tests are beyond the technical capability of regular POS employees.

The POS makes their income from selling air-time and accessories. They regard testing phones as a complex burden and a major distraction from their core business.

Carriers are now addressing the NTF filtering problem by moving phone testing to regional depots from the point of sale. The main advantage of this strategy is that it transfers the burden of testing to the wireless carrier from the POS. However, the disadvantages include:

Increased time taken to determine whether a phone has a real problem because phones have to be shipped from the POS to the depot before a fault is confirmed or eliminated.

Rather than filtering NTF phones at the POS, the POS accepts and forwards NTF phones to the depot.

Carriers must handle and refurbish NTF phones before using them to replenish the pool of loaner phones.

The pool of loaner phones is larger than necessary because sufficient loaner phones are required to substitute for the large number of NTF phones that are accepted from customers.

The Customer Service Expert improves on prior art because it:

Improves the efficiency and level of competence of customer service representatives and field technicians.

Enables proactive fault diagnosis and resolution including periodic checks of performance of in-service phones.

Uses each customer contact to improve market intelligence, increase revenues, reduce costs and better educate customers on correct use of the phone and network.

Integrates phone problem resolution with network problem resolution. The two cannot easily be separated.

Eliminates NTF phones before they leave the customer. This prevents the unnecessary NTF liability from being transferred to manufacturers, depots or points of sale.

Reduces the number of loaner phones required by wireless carriers.

Transfers the cost of resolving the NTF phone problem from the point of sale to the carriers and manufacturers who benefit most when the problem is reduced or eliminated.

## SUMMARY OF THE INVENTION

The purpose of the advanced customer care system is to improve the efficiency, proactiveness and level of competence of customer service representatives, field technicians and other employees of wireless and related companies.

This is primarily achieved by codifying a number of complex procedures into an expert system. The expert system then poses a sequence of simple questions which a customer can answer, to help the expert system make decisions. These decisions would normally require the dedicated time and large expense of an employee who has a high level of expertise in that problem area.

The architecture of the customer service expert is depicted in Attachment 1. A summary of the rules and flow are depicted in attachments 2 and 3. The main components of the expert system environment include: advanced customer care system; the wireless phone; the Hand Held PC ("HHPC"); the Cellular Test Set; the Cellular Network - including a cell site and a mobile telephone switching office ("MTSO"); the Wireline Network, including the central office ("CO"), trunk network and local loops; the user; and the customer service representative.

A number of different levels of access, diagnosis and intelligence gathering are offered, including the following:

**Level 1 Access** - The customer calls the customer service representative with a query. In the case of a suspected phone problem the customer service representative will interrogate the customer to determine the phone model. The expert system is coded with the most probable faults associated with each model of phone. The expert system uses this information to prompt the

customer service representative to ask the customer a sequence of questions that will help confirm or eliminate the most probable faults for that model of phone.

**Level 2 Access** - The customer uses a hand-held personal computer ("HHPC") to gain direct access to the expert system. The HHPC presents a user friendly graphical user interface that displays the expert system's sequence of questions and enables the user to select among multiple choice answers. These answers will help the expert system confirm or eliminate the most probable reasons for a query, such as a suspected faulty phone. The HHPC could also offer the customer a number of utilities such as access to general information about his service and the ability to effect a periodic performance check on a phone. However, to run an annual phone check, level 3 access is required.

**Level 3 Access** - while speaking with a customer service representative or using a HHPC to access the expert system directly, the customer also uses the mobile phone under text to access the wireless network. The expert system can retrieve, from the network, information about the communication characteristics of the phone or even redirect, to a test set, the channel used by the "phone under test". This test set may be located at the cell site or a more appropriate site and can be used to implement more detailed measurements of the phone's performance.

**Network Problem Diagnosis** - In the case of a suspected faulty phone, the expert system can interrogate network components to help determine whether the customer's complaint is caused by the network rather than the phone. Relevant information can be revealed to the customer by the customer service representative or via the HHPC. For example, a particular cell site may have been experiencing technical difficulties which interrupted communications at the time the customer thought her phone had a problem.

**Market Intelligence Gathering** - At an opportune moment, the expert system can present to the customer service representative, or directly to the HHPC, a number of special offers that may appeal to the customer based on the wireless carrier's marketing objectives and the customer's profile (codified in the expert system). The expert system also can ask the customer a

number of questions that will help improve the carrier's knowledge of market needs and trends. This information can be used to reduce subscriber acquisition and retention costs.

### 1) Definition of the SmartCare™ System

A mission-critical business system that creates competitive advantage by reengineering the interface between a carrier's two most important assets, its employees and its subscribers.

### 2) Summary of Invention

The SmartCare™ System deploys artificial intelligence in an expert system to enable regular customer care agents ("CCAs") to perform like customer service experts. Expertise from a number of CCAs and specialists, such as technical support engineers and billing and activation specialists, is codified in the expert system to create a decision tree that guides CCAs through the discovery, diagnosis, resolution and audit trail process for all types of subscriber inquiries. The questions and statements that the CCA needs to pose to the subscriber, to extract or impart information, are scripted on the screen of the CCA's terminal. The SmartCare™ System also interfaces with the carrier's legacy systems to automatically retrieve data, such as status of account or most recent reported trouble, to facilitate the inquiry resolution process. This "gateway" function eliminates the need for CCAs to learn a different interface for each legacy system. The SmartCare™ System also enables management to trace the performance of each CCA using a number of metrics.

The combination of the expert rules and process flows empowers the CCA to provide service that is more efficient, accurate and consistent. The SmartCare™ rules and flows also empower CCAs to perform tasks that currently require experts, such as telemarketing professionals, technical support engineers and billing and activation specialists.

In summary, the benefits of the SmartCare™ System include:

Increase revenues through telemarketing, cross selling, premium features and rapid activations.

Empower CCAs to perform selling, activation, billing, diagnosis, resolution and audit trail tasks.

Reduce churn by proactively informing premium users of quality issues and loyalty promotions.

Exceed caller expectations by more consistent, efficient and accurate service from all CCAs.

Increase the number of trouble reports that are resolved during the first call.

Reduce the average training time for CCAs.

Reduce call backs and repeats due to more accurate and faster discovery and resolution.

Improve quality of dispatch of field technicians due to more accurate discovery and diagnosis.

Track performance of CCAs and the performance of the SmartCare<sup>TM</sup> System.

3) Description of Modules - see Figure 7 of the drawings:

Harris Corp's SmartCare<sup>TM</sup> Advanced Customer Care System consists of the following modules.

The Decision Tree Module scripts a sequence of questions and statements to guide your CCAs through telemarketing and proactive maintenance of premium accounts. It also guides CCAs through discovery, diagnosis, resolution, cross selling and audit trail for incoming calls.

The Gateway Module enables your CCAs to use one Man Machine Interface ("MMI") to gain real time access to information from your multi-vendor legacy systems.

The Expert System Module analyzes data gathered from the subscriber and your legacy systems, then uses pre-defined decision criteria to conclude each customer contact.

The Datamining and Data Warehouse Module automatically monitors legacy data for pre-defined conditions and trends then recommends telemarketing actions and proactive

"telemaintenance" calls to premium accounts. The data warehouse logs critical events for use by the expert system.

The Audit Trail and Trouble Ticketing Module enables a record of all customer contacts to be logged in accordance with a carrier's standard operating practices.

The Remote Access Module enables remote users to access Harris Corp's SmartCare™ System via your intranet or over the internet using a regular or hand held P.C.

The Test Head Module enables on-line diagnostic testing of phones and facilities.

The Executive Module enables system administrators to monitor and maintain the SmartCare™ System and enables supervisors to monitor and measure the performance of customer care agents and other employees that use the system, such as technical specialists.

#### Enhancements to SmartCare Systems:

One of the key features of this system is the collecting of normally diverse and/or unavailable data into a single processing source. The availability of this data to automated reasoning or artificial intelligent techniques is very powerful and opens up a whole realm of possibilities.

This level of capability can be thought of as a fourth level in which there is no human interaction at all required for the system to perform its functions. That is the system decides to access data, analyzes and processes the data, makes decisions about what to do based on the results of those decisions, and acts on those decisions all autonomously. The type of actions the system can take include the following : alert a human; run a test; change its own configuration; change the configuration of the outside world (within the boundaries of its authority) e.g. modify the network, modify a database, etc.

**Learning:**

Given information about user performance/utilization captured through the logging function, the system can learn and improve its own behaviour. For example, using learning heuristics, the system can tell if certain user functions are consistently performed in the same way, create its own rules to automate those functions and instantaneously be more tailored and efficient for the user. The system can observe diagnostic paths that it has not seen before that are successful and capture them for future use.

**Intelligent Decision Aiding:**

The system can process historical data about customers and users in a manner to be useful in strategic decision makers and provide that information in a graphical and user friendly way. The system can even be programmed to watch for trends, and alert both tactical and strategic decision makers about potential problems or opportunities.

**Intelligent Data Access:**

As databases accessed by the system become more complex and in cases less reliable, intelligent data access will be a key feature. This involves using heuristics to decide the best data source given the current situation (user state and data needs) and knowledge about the data source capabilities as well as limitations. When the system is hooked into the intranet and the internet, the courses of data become much broader. Access to this data can redefine how customer care is performed but also requires more intelligence about how the data is used.

**Intelligent User Interface:**

Artificial intelligence and user interface automation techniques can be applied to create an intelligent interface that serves to minimize the workload of the user while maximizing the user's situation awareness. This can be achieved by understanding (both via the user log-on data and the way the user is interacting with the system) the skill level and situational data needs of the user in

context and providing just the right level of information in the best format. The display can be tailored as a function of user skill, workload, type, and data needs.

**Intelligent Training:**

Access to data plus artificial intelligence techniques also opens up powerful training opportunities. The system could automatically create training scenarios from real life scenarios. The system could modify the scenarios in real time if they seem to be too challenging or easy for the user based on how the user is interacting with the system. CCA supervisors could observe (watch and listen) training scenarios remotely from their own terminals and thereby observe performance without affecting it by their presence. Training sessions can be logged and replayed for both the trainee and the trainer. The system could analyze the training session and provide suggestions or pointers to the trainee.

CLAIMS:

1. A method of using a telecommunication network having a customer service facility to which inquiries may be directed by a user of said network for resolution of a problem related to the use of a wireless communication device or telecommunication services accessible by such device, a method of obtaining a resolution of said problem comprising the steps of:

(a) providing a telecommunication workstation at which a customer service representative may communicate with said user of said network, said workstation being coupled to an automated diagnostic and problem resolution routine that is interfaced with one or more telecommunication databases and a network performance monitoring subsystem of a telecommunication service provider, said routine being operative to generate a user interface at said workstation through which said customer service representative is guided through a series interactive communication steps with said user to diagnose said one or more problems related to the use of said wireless communication device; and

(b) in response to an inquiry from said user of said system for resolution of a problem related to the use of said wireless communication device or telecommunication services accessible by such device, executing said routine so as to cause said workstation to direct a customer service representative through said series of interactive communication steps with said user that diagnose said problem.

2. A method as claimed in claim 1, wherein said routine is operative to monitor said network performance subsystem for anomalies that may impair or interrupt wireless service to one or more customers and, in response to an anomaly, to access a database containing customer service representative procedure rules associated with said anomaly and provide an indication of the anomaly by way of said telecommunication workstation, in which said user interface is configured to include a map showing a location of said user within said network and to provide instructions that direct said customer service representative through said series of interactive communication steps with said user.

3. A method as claimed in claims 1 or 2, wherein said inquiry comprises a digital data communication sourced from a telecommunication terminal, or said inquiry comprises a voice call.

4. A method as claimed in any one of claims 1 to 3, wherein said routine is operative to access an auxiliary database containing information relating to said user's wireless communication device, including one or more aspects of said user's wireless communication device that have been previously identified as potential causes of a problem with said wireless communication device, said routine is operative, in response to a first series of interactive steps between said user and said customer service representative not having successfully diagnosed and resolved said problem, to direct said customer service representative to request said user to place a call from said user's wireless communication device to a test site and thereby place said user's wireless communication device in a test path with performance monitoring equipment at said test site.

5. A method as claimed in claim 4, wherein said routine is operative to selectively cause said communication path with said user's wireless communication device to be coupled to a test device at said test site, and said routine is operative to determine whether said problem is caused by said user's wireless communication device or said network, preferably said routine is operative, in response to a first series of interactive steps between said user and said customer service representative not successfully diagnosing and resolving said problem, to direct said customer service representative to conduct one or more additional series of interactive steps with said user associated with alternative diagnoses and solutions of said problem.

6. A method as claimed in any one of claims 1 to 5, wherein said routine is operative, in response to a series of interactive steps between said user and said customer service representative not successfully diagnosing and resolving said problem, to direct said customer service representative to request said user to cause said user's wireless communication device to be conveyed to service facility for service or replacement, in which said routine is operative, in response to a series of interactive steps between said user and said customer service representative not successfully diagnosing and resolving said problem, to direct said customer service representative to instruct said user regarding continued use of said user's wireless communication device.

7. A system for diagnosing a problem related to the use of a wireless communication device employed by a customer of a telecommunication network, comprising a customer service facility to which inquiries are directed by customers of said network in the event of problems related to the use of said wireless communication device in conducting communications over said network, said customer service facility having a plurality of telecommunication workstations at which a customer service representatives may communicate with said customers, and a respective workstation is operative to execute an automated diagnostic and problem resolution routine that is interfaced with one or more telecommunication databases and a network performance monitoring subsystem of said network, said routine being operative to generate a user interface at said workstation that directs a customer service representative through a series interactive communication steps with said customer to diagnose said problem, including selectively instructing said customer to place a call from said wireless communication device to a test site and thereby place said wireless communication device in a test path with performance monitoring equipment at said test site.

8. A system as claimed in claim 7, wherein said routine is operative to monitor said network performance subsystem for anomalies that may impair or interrupt wireless service to one or more customers and, in response to an anomaly, to access a database containing customer service representative procedure rules associated with said anomaly and provide an indication of the anomaly by way of said telecommunication workstation, in which said user interface is configured to generate instructions directing said customer service representative through said series of interactive communication steps with said customer, and a customer inquiry comprises a digital data communication sourced from a telecommunication terminal, or a voice call.

9. A system as claimed in claims 7 or 8, wherein said routine is operative to access an auxiliary database containing information relating to said wireless communication device, including one or more aspects of said wireless communication device that have been previously identified as potential causes of a problem with said wireless communication device, in which said routine is operative, in response to a first series of interactive steps between said customer service representative and said customer not having successfully diagnosed said problem, to direct said

customer service representative to request said user to place a call from said wireless communication device to a test site and thereby place said wireless communication device in a test path with performance monitoring equipment at said test site, and said routine is operative to selectively cause said communication path with said wireless communication device to be coupled to a test device at said test site, preferably said routine is operative to determine whether said problem is caused by said wireless communication device or said network.

10. A system as claimed in claim 9, wherein said routine is operative, in response to a first series of interactive steps between said customer service representative and said customer not successfully diagnosing said problem, to direct said customer service representative to conduct one or more additional series of interactive steps with said customer associated with alternative diagnoses of said problem, in which said routine is operative, in response to a series of interactive steps between said customer service representative and said customer not successfully diagnosing and resolving said problem, to direct said customer service representative to request said user to cause said user's wireless communication device to be conveyed to service facility for service or replacement, and preferably in response to a series of interactive steps between said customer service representative and said customer not successfully diagnosing said problem, to direct said customer service representative to instruct said customer regarding continued use of said user's wireless communication device.

1/4

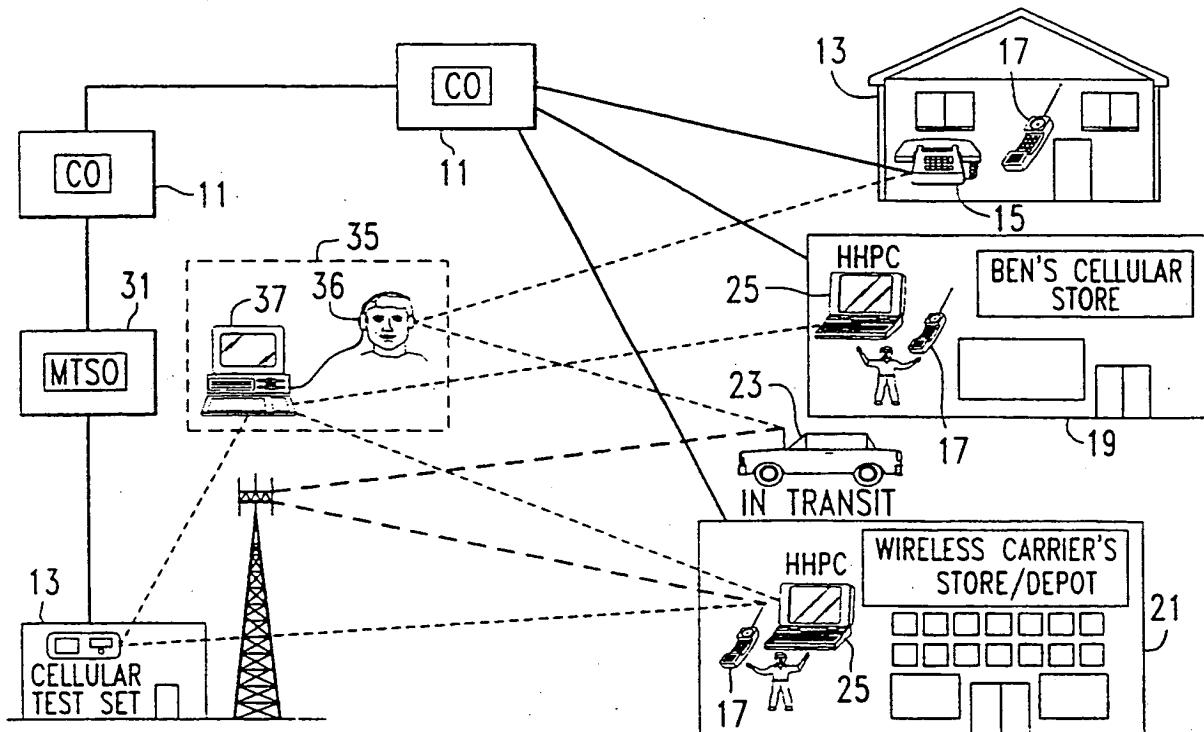


FIG. 1

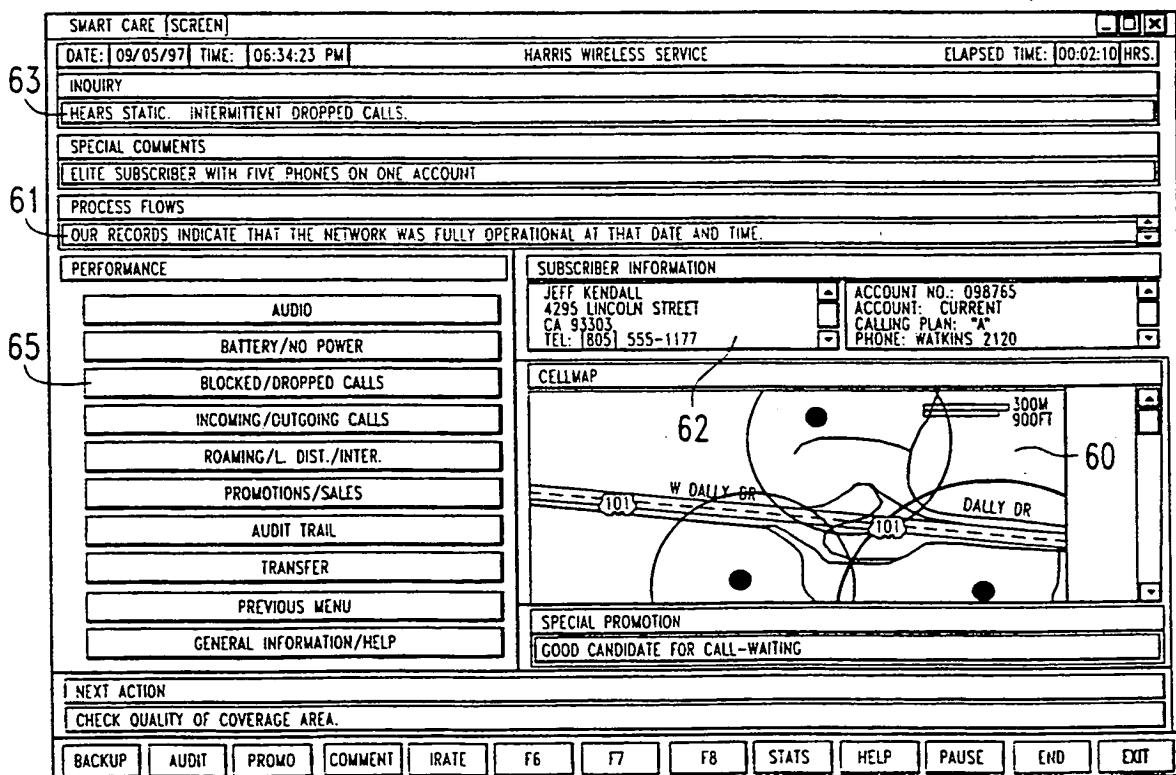


FIG. 6

2/4

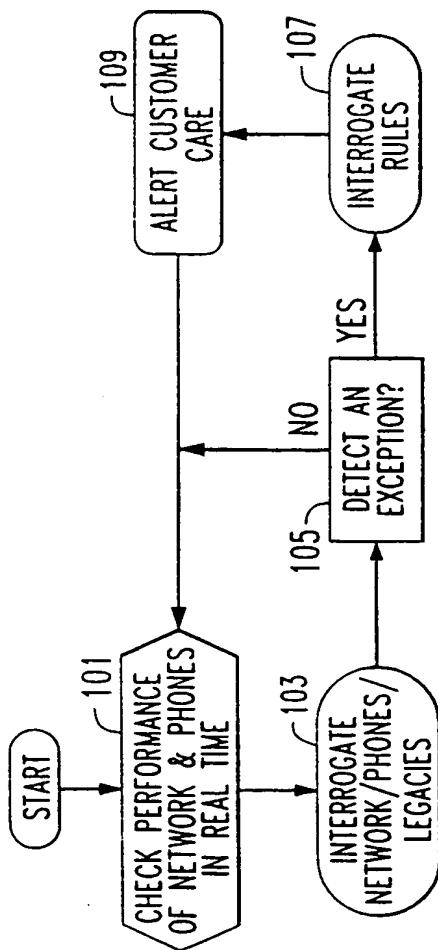


FIG. 2

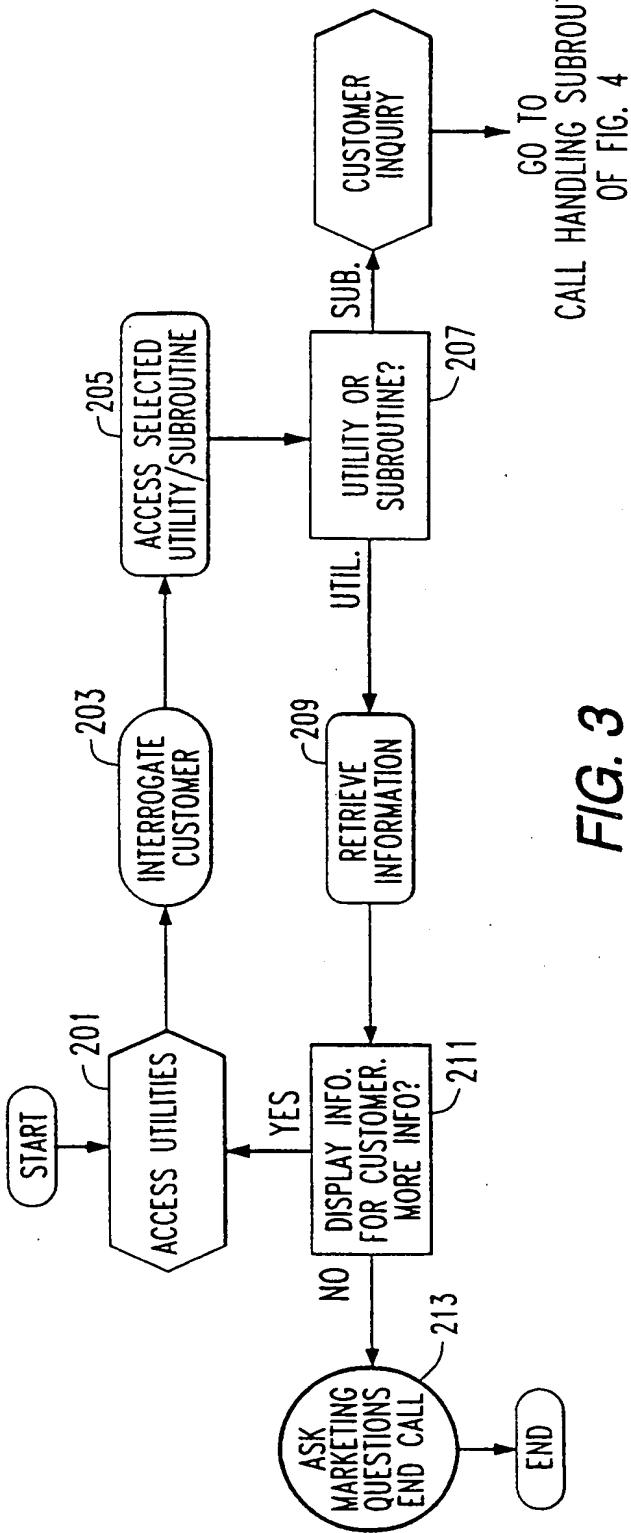


FIG. 3

3/4

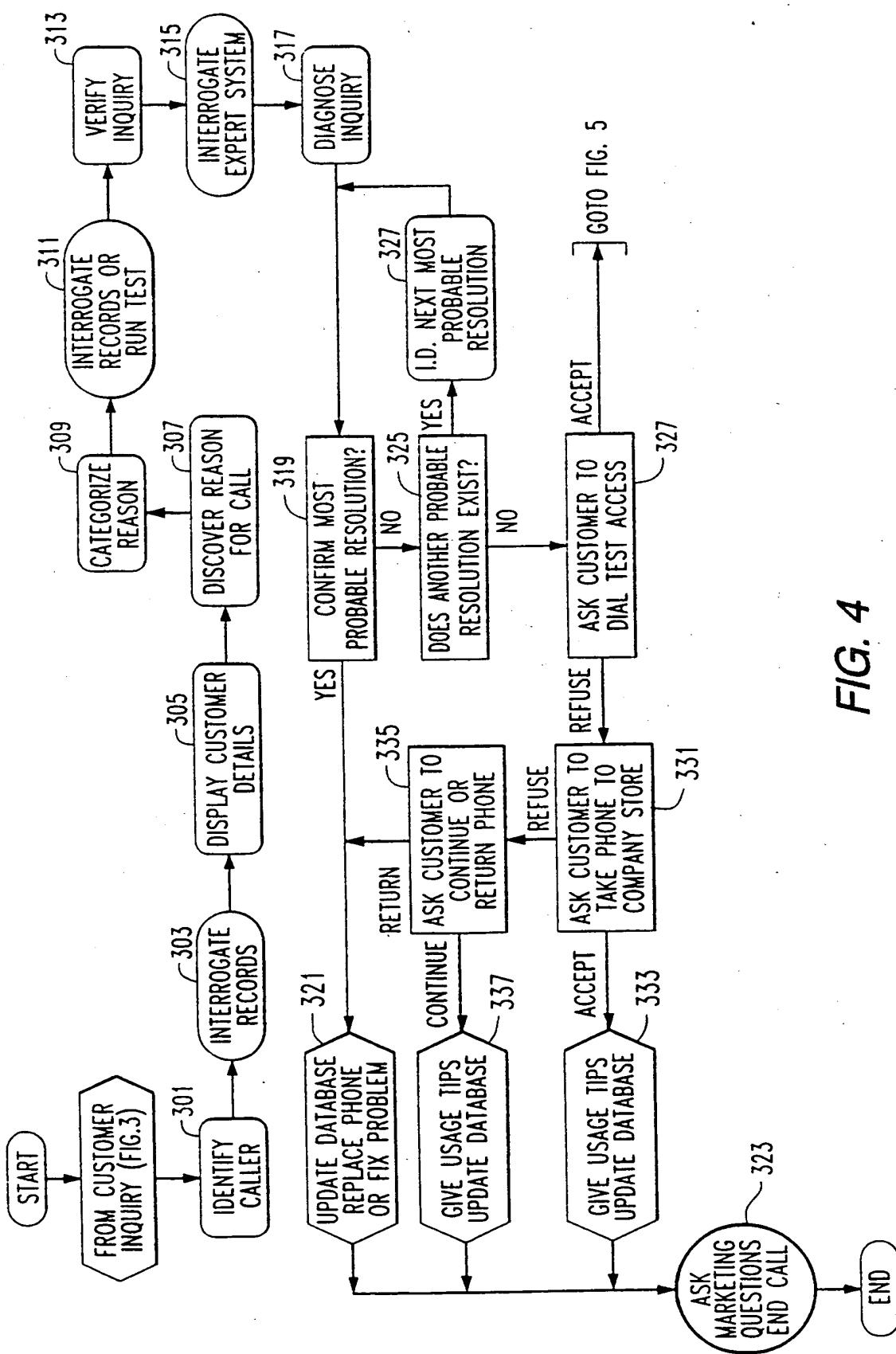


FIG. 4

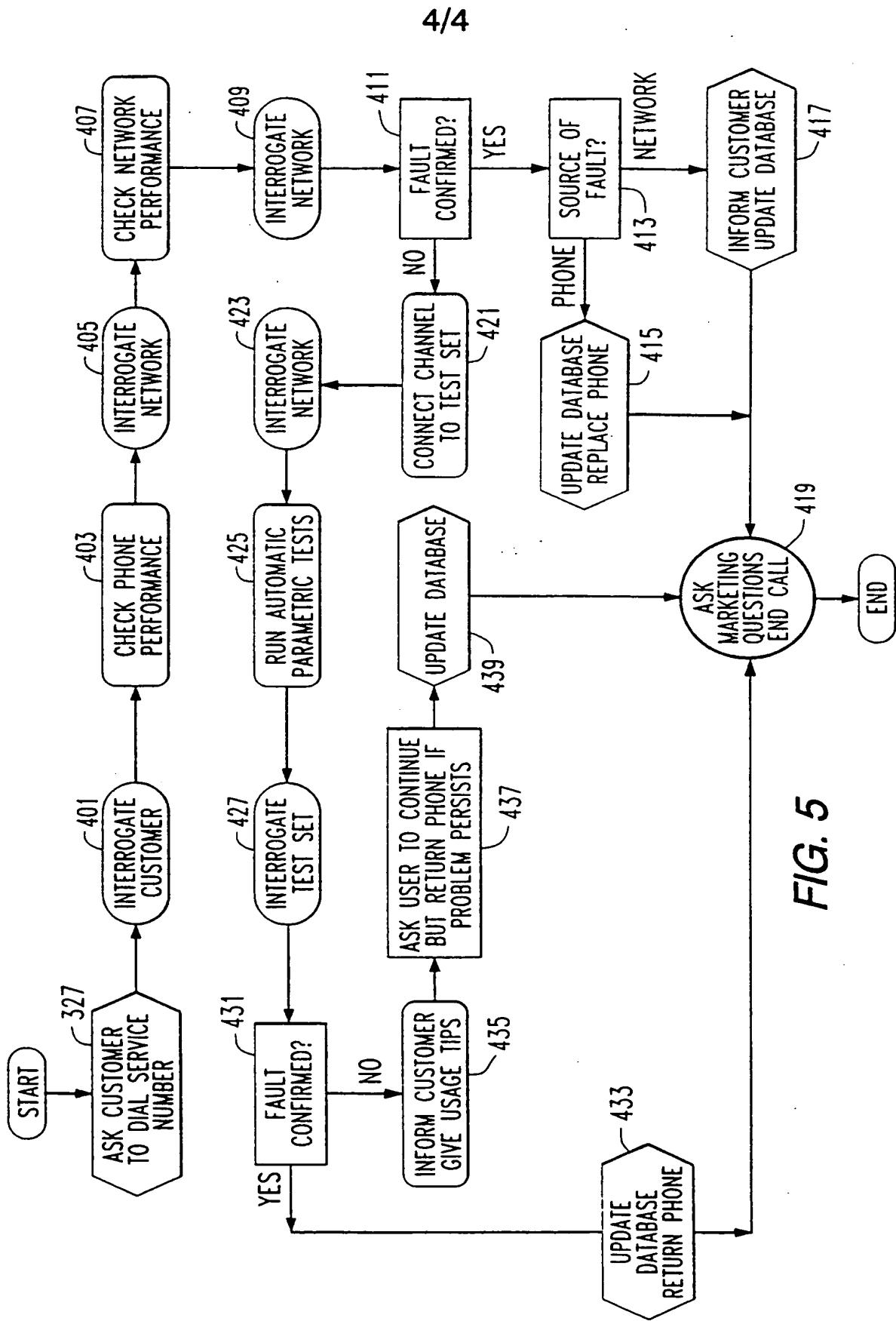


FIG. 5



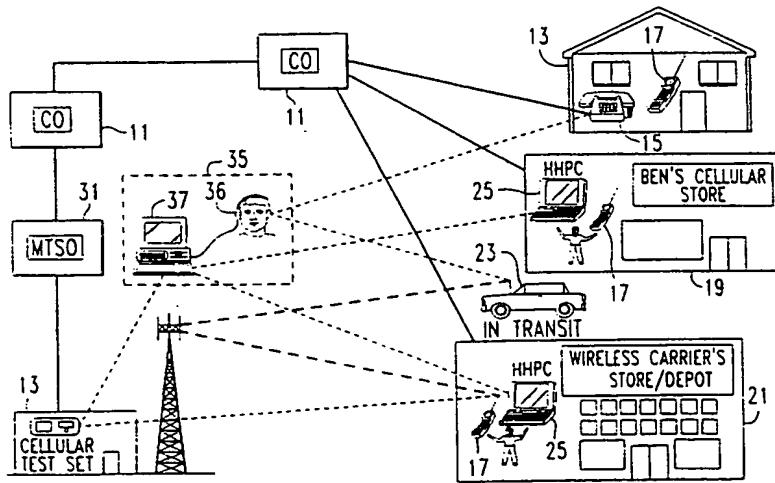


## INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

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(54) Title: CUSTOMER SERVICE REPRESENTATIVE INTERACTIVE SYSTEM FOR DIAGNOSING AND RESOLVING PROBLEMS IN THE OPERATION AND USE OF WIRELESS TELECOMMUNICATION EQUIPMENT



## (57) Abstract

A system for diagnosing a problem related to the use of a wireless communication device, such as a cellular phone (17), of a customer of a telecommunication network includes a customer service facility (35) to which inquiries are directed by customers of the network in the event of problems with their cellular phones. The customer service facility has a plurality of workstations (37) from which customer service representatives (36) interact with customers to diagnose and resolve problems. In response to an incoming call from a customer, a workstation executes an automated diagnostic and problem resolution routine that is interfaced with one or more telecommunication databases and a network performance monitoring subsystem. This diagnostic routine generates a user interface that directs the customer service representative through a series interactive communication steps with a customer to diagnose the problem.

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# INTERNATIONAL SEARCH REPORT

International Application No

PCT/GB 98/00580

**A. CLASSIFICATION OF SUBJECT MATTER**  
 IPC 6 H04Q7/34 H04B17/00

According to International Patent Classification (IPC) or to both national classification and IPC

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Minimum documentation searched (classification system followed by classification symbols)  
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**C. DOCUMENTS CONSIDERED TO BE RELEVANT**

Category	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 5 285 494 A (SPRECHER JERRY W ET AL) 8 February 1994 see column 1, line 29 - line 52 see column 2, line 64 - column 3, line 10 see column 4, line 13 - line 19 see column 5, line 55 - column 6, line 2 see column 10, line 57 - line 64 see column 11, line 59 - line 63 see claims 1,2,4,5,12,16 ---	1-3
Y	see column 1, line 29 - line 52 see column 2, line 64 - column 3, line 10 see column 4, line 13 - line 19 see column 5, line 55 - column 6, line 2 see column 10, line 57 - line 64 see column 11, line 59 - line 63 see claims 1,2,4,5,12,16 ---	7,9
Y	EP 0 673 176 A (SIEMENS AG) 20 September 1995	7,9
A	see column 1, line 29 - line 35 see column 2, line 19 - line 31 see claims 1-3,6-9 ---	1-5,8
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## C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

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A	REMONDINO G ET AL: "AN EXPERT SYSTEM FOR RADIO MOBILE NETWORK MONITORING" PROCEEDINGS OF THE INTERNATIONAL CONFERENCE ON COMMUNICATIONS (ICC), GENEVA, vol. 3, 23 - 26 May 1993, pages 1885-1889, XP000448447 INSTITUTE OF ELECTRICAL AND ELECTRONICS ENGINEERS see sections 2,3 ---	1-3, 7-9
A	US 5 031 204 A (MCKERNAN RANDOLPH W) 9 July 1991 see the whole document -----	

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## Information on patent family members

I. International Application No

PCT/GB 98/00580

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
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